

Introduction to Anatomy

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K.M

Dr. : Khaled Milad "Km"

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INTRODUCTION

* Anatomy :- Is a Greek word means cutting up or (cutting through) (ana = through , tom = cut , y = forming noun)
 - It is the science of studying the structure of the human body. & function

* The human body consists of :-

- Systems :- formed of a group of organs.
- Organs :- formed of different tissues.
- Tissue :- formed of cells.
- Cell :- is the basic structural unit of the body.

* Divisions of anatomy :-

(1) Microscopic anatomy :- → Histology.

(2) Macroscopic (Gross) anatomy :- Divides into :-

(a) Regional anatomy :- e.g thorax, abdomen, upper limb, lower limb, head & neck, ... - etc.

(b) Systemic anatomy :- e.g

- Dermatology = integumentary system (skin)
- Myology = Muscular system.
- Osteology = skeletal system.
- Arthrology = articular system (Joints).
- Angiology = circulatory system
- Neurology = Nervous system.

(3) Other subdivisions :-

- Clinical (applied) anatomy.
- Surface anatomy.
- Radiological anatomy.
- Developmental anatomy (embryology).

ANATOMICAL TERMS

* Anatomical Position :-

- The person standing erect.
 - upper limbs by the sides.
 - Lower limbs close together.
 - Face & Palms directed forward.

* Anatomical Planes :-

① - Median (Midsagittal) Plane :-

- Vertical plane which divides the body into equal right and left halves (passing in centre of body).

② - Para Median (Para sagittal) Plane :-

- Vertical plane which divides the body into unequal right and left parts (parallel to median plane).

③ - Coronal (Frontal) Plane :-

- Vertical plane which divides the body into anterior and posterior parts (at right angle to median plane).

④ - Horizontal (transverse) plane :-

- Transverse plane which divides the body into upper and lower parts (at right angle to Median & coronal planes).

* Terms of position :-

- Anterior :- on the front of body or near to it.
 - In embryo : called ventral.
 - In hand : called palmar surface
- Posterior :- on the back of body or near to it
 - In embryo :- called dorsal
 - In hand : called dorsal surface

- Superior :- on top of body (head) or near to it.
 - In embryo: called cephalic or cranial.
 - In foot: called dorsal surface.
- Inferior :- on lower part of body or near to it.
 - In embryo:- called caudal.
 - In foot: called Plantar surface.
- Medial :- position nearer to the median plane than another.
- Lateral :- position away from the median plane.
- Intermediate :- position between medial & Lateral points.
- Superficial :- position nearer to body surface.
- deep :- the position away from body surface.
- External :- position away from cavity of a viscus.
- Internal :- position nearer to cavity of a viscus.
- Middle :- between external & internal /or superficial & deep.
- proximal :- position close to trunk or root of the limb.
- Distal :- position away from trunk or root of the limb.
- Ipsilateral :- refers to the same side of the body e.g
Left hand & Left foot are ipsilateral.
- Contralateral :- refers to opposite side of the body e.g
right hand & Left foot are contralateral.
- UniLateral :- structure occur on on side only e.g spleen.
- Bi Lateral :- paired structures (having Rt & Lt) e.g kidneys.
- Supine :- the body is lying on back (ventral surface up).
- prone :- the body is lying face downward (ventral surface down).

NB :- positions of body are

- anatomical position.
- supine position.
- prone position.

Terms of movement

* Flexion: bending of joint anteriorly (in knee bending posteriorly).

* Extension: straightening the joint (reverse of flexion).

.NB • Both flexion & extension occur in sagittal plane.

.NB • Lateral flexion of trunk occurs in coronal plane.

* Adduction: movement medially toward midline.

* Abduction: movement laterally away from midline.

.NB • Both adduction & abduction occur in coronal plane.

* Medial Rotation: movement of anterior surface medially.

* Lateral Rotation: movement of anterior surface laterally.

.NB • Rotation: movement of a part around its long axis.

* Supination: lateral rotation of forearm (palm facing upward).

* Pronation: medial rotation of forearm (palm facing downward).

.NB • Circumduction: combination of flexion, ext., add. & abduction.

* Inversion: medial rotation of foot (sole facing inward).

* Eversion: lateral rotation of foot (sole facing outward).

* Elevation: moving up. (e.g. upper eyelid when opening the eye)

* Depression: moving down. (e.g. depressing shoulder).

* protraction: moving anteriorly. (e.g. mandible & scapula).

* retraction: moving posteriorly (backward).

* opposition: moving the thumb against another digit.

* reposition: moving the thumb back to anatomical position from opposition (reverse of opposition).

.NB • Protrusion = protraction / retrusion = retraction.

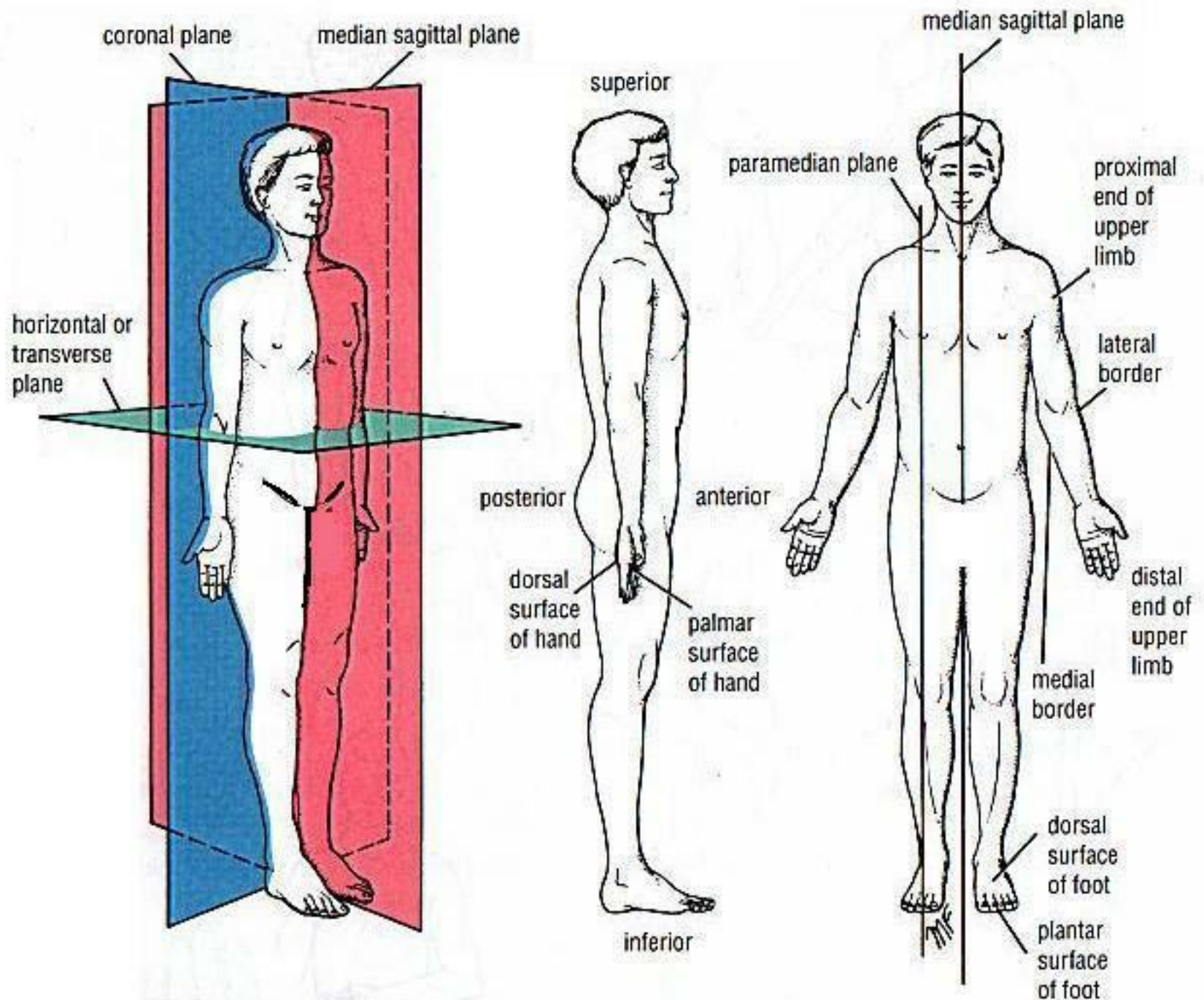


Figure 1-1 Anatomic terms used in relation to position. Note that the subjects are standing in the anatomic position.

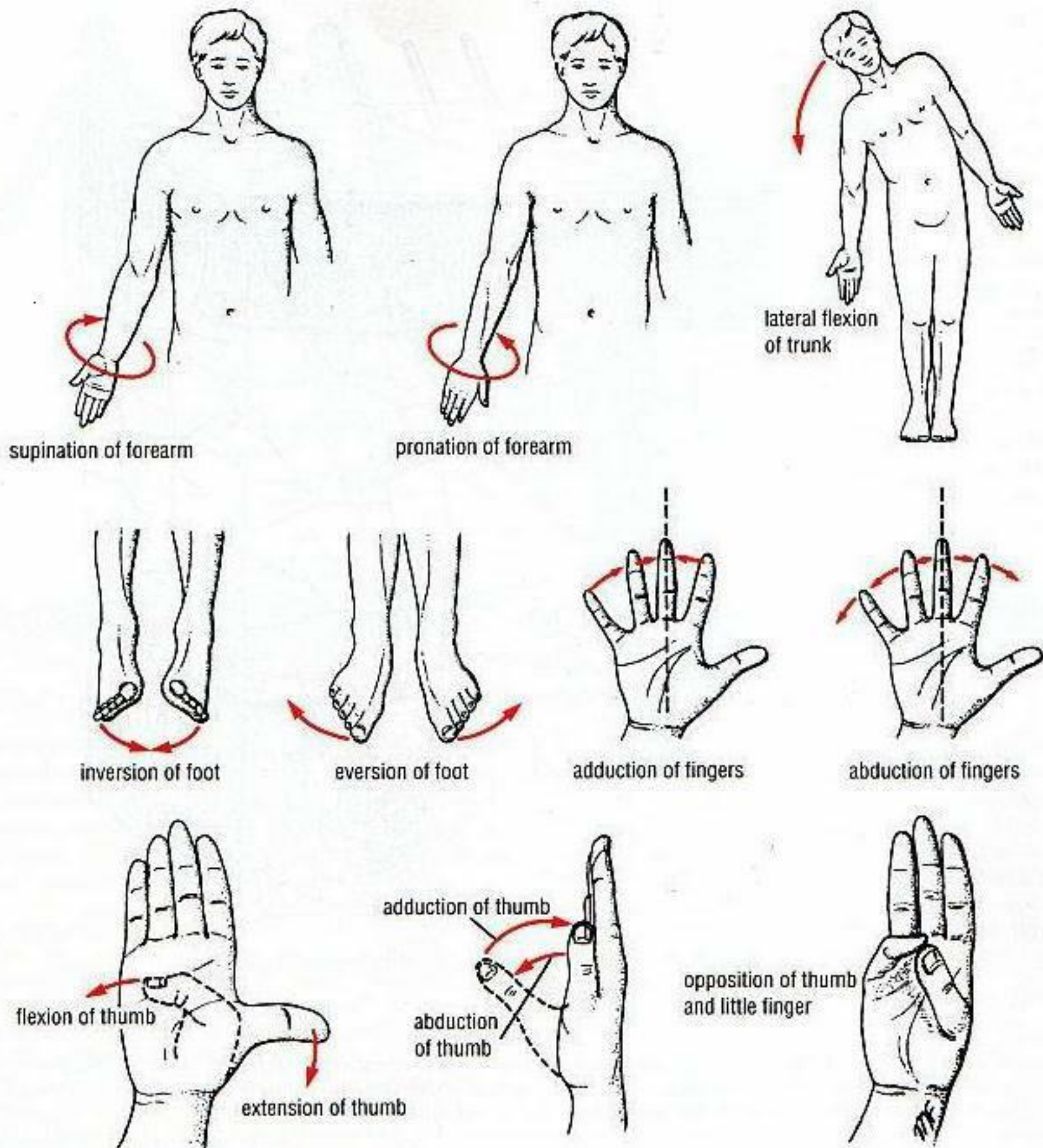


Figure 1-3 Additional anatomic terms used in relation to movement.

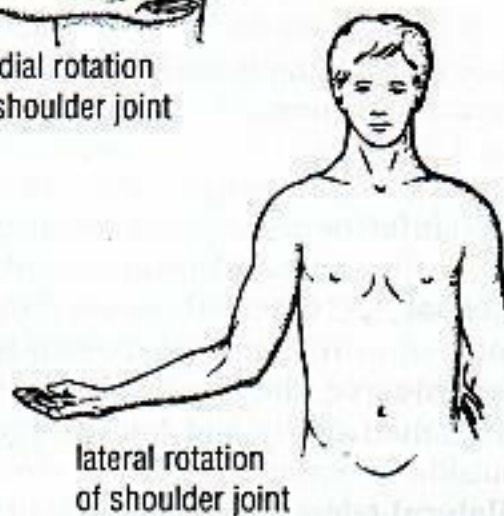
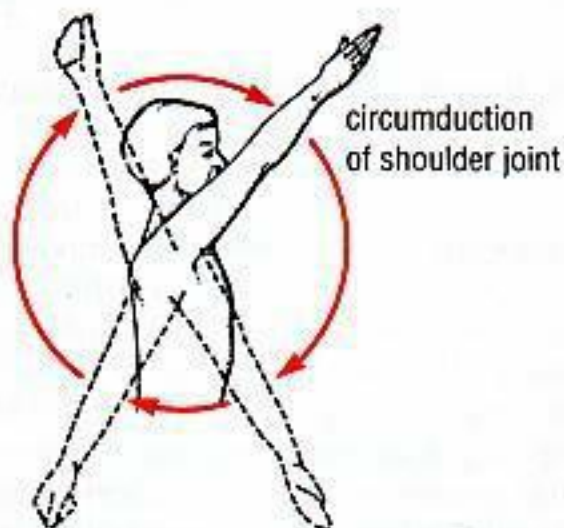
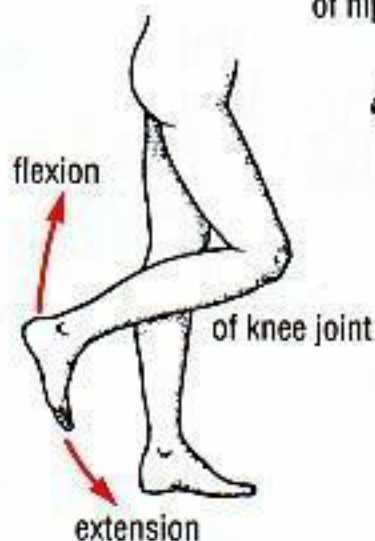
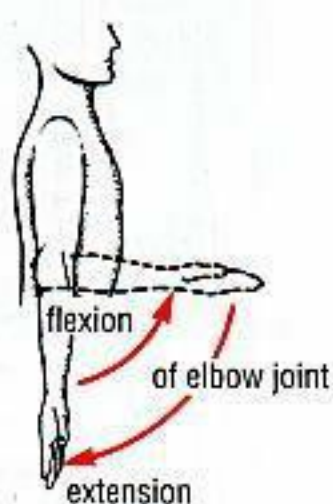
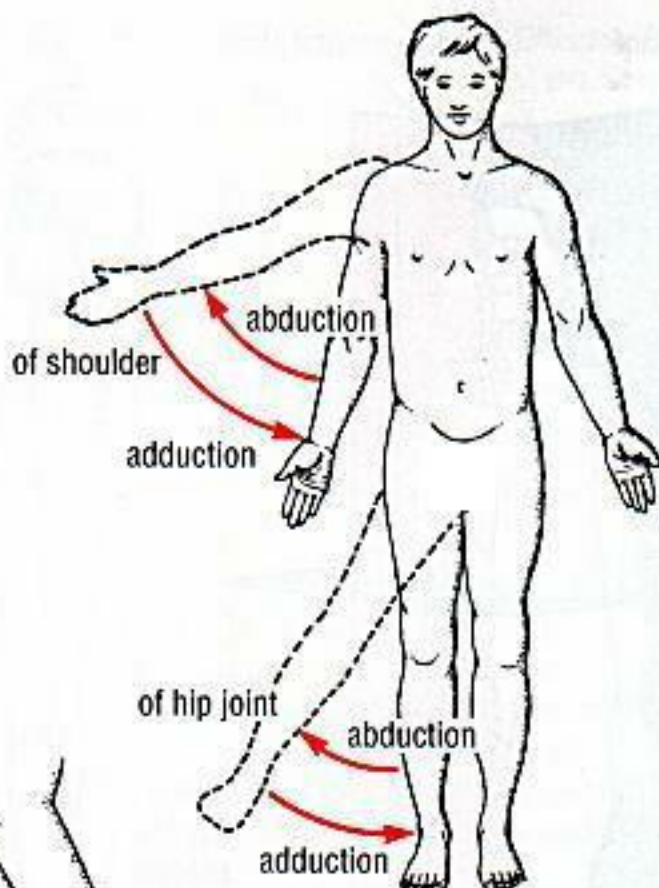
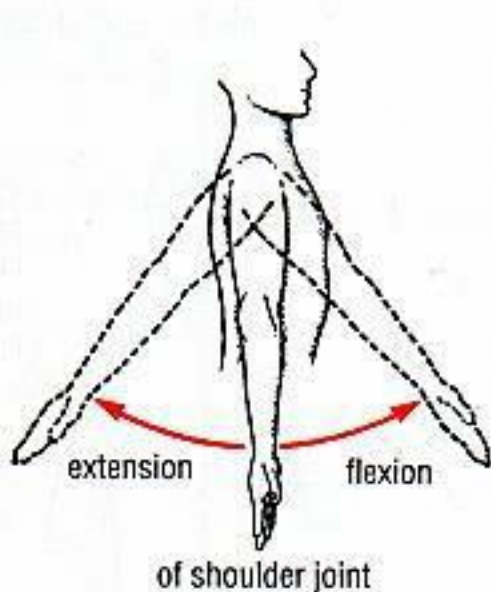


Figure 1-2 Some anatomic terms used in relation to movement. Note the difference between flexion of the elbow and that of the knee.

THE SKIN

■ Skin is the largest organ in the body.

■ It is formed of epidermis & dermis :-

* Epidermis :- (superficial layer) :-

- A keratinized stratified squamous epithelium.
- Ectodermal in origin.
- It is thick in palm & sole, thin on front of arm & forearm.

* Dermis :- (deep layer) :-

- Deep connective tissue layer, contain B.V, lymph & nerves.
- Mesodermal in origin.
- It is thinner on anterior than posterior surfaces and thinner in women than men

* Function of skin :-

1. Protection of deeper structures (from abrasions, micro-organisms as bacteria).
2. Prevent fluid loss.
3. Sensation (Pain, touch, temperature) by nerve endings.
4. Secretions (sweat, sebum, milk) "excretion & absorption"
5. regulation of body temperature.
6. synthesis & storage of vitamin D.

* Lines of skin :-

①. Visible lines :- e.g

- Papillary ridges → (finger prints) (Dermatoglyphics).
- Skin creases : → folds of skin at joints, it is thin skin that attach firmly to deep structures (by fibrous band)
- Wrinkles.

② Invisble lines :-

- Langer's lines (lines of cleavage) :- formed of bundles of collagen fibers in parallel rows in dermis.
 - they run longitudinally in limbs and circumferentially in the neck & trunk.
 - Incision along these lines heal with minimal scar.

* Appendages of skin

1. Nail.
2. Hair & hair follicles.
3. Sebaceous glands.
4. Sweat glands.

* Sites with no hair :-

1. Palms & sole.
2. Sides of fingers & toes & feet.
3. Lips.
4. Glans penis.
5. Clitoris.

* Sites with no sweat glands :-

1. Nail beds.
2. Red margin of the lips.
3. Glans penis.
4. Clitoris

NB :- Skin ligaments (Retinacula cutis) :-

- they extend from deep dermis to deep fascia to fix skin
- in Palm it is dense than in dorsum of hand.

NB :- Rule of Nine (in Burns)

- | | |
|-----------------------|-------------------------|
| - head & neck 9% | - front of trunk 18% |
| - each upper limb 9% | - back of trunk 18% |
| - each lower limb 18% | - external genitalia 1% |

② Inelastic lines :-

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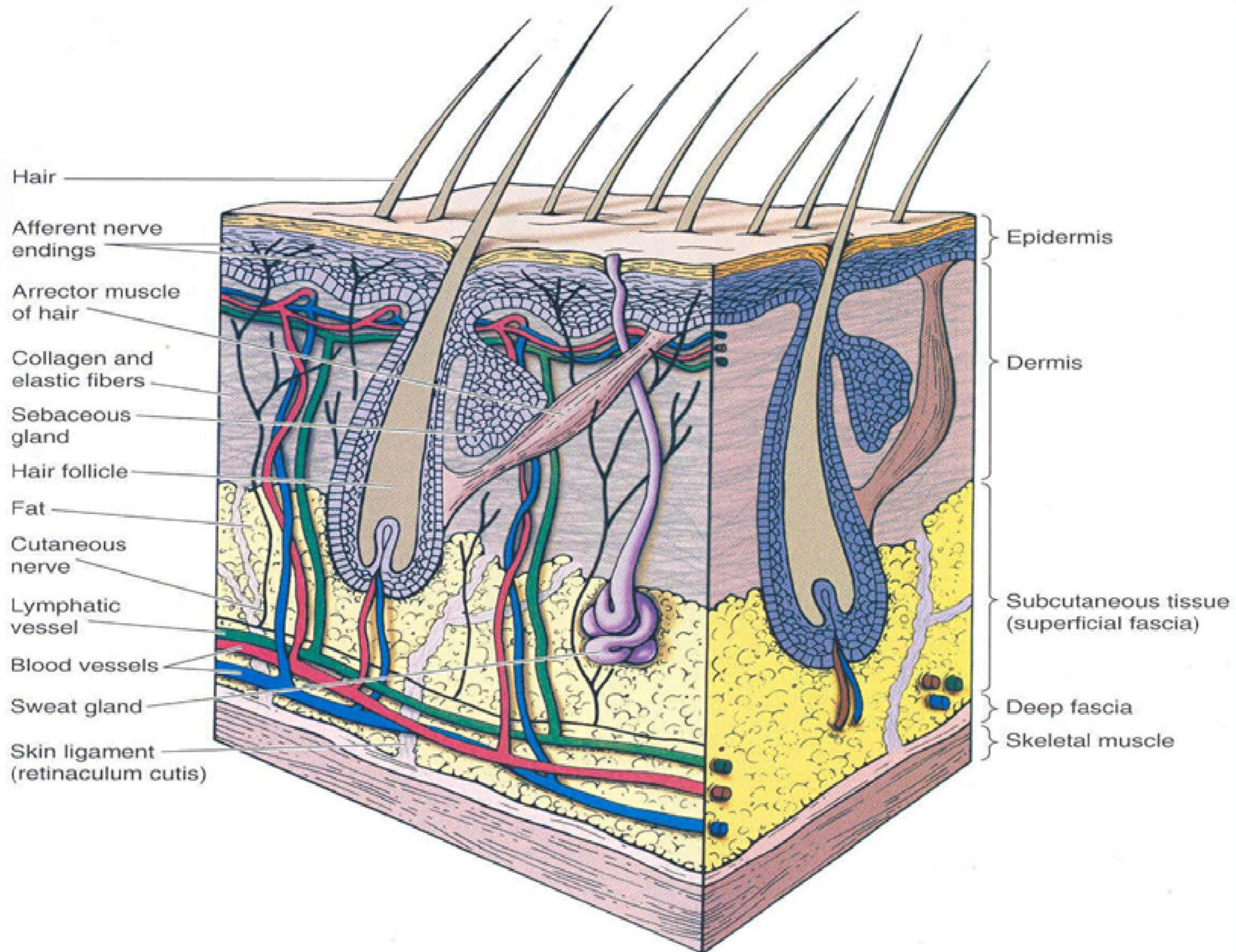


Figure 1.6. Schematic drawing of the skin and its appendages. The layered arrangement of the body's covering and the hairs and glands embedded within the skin and subcutaneous tissue are demonstrated here.

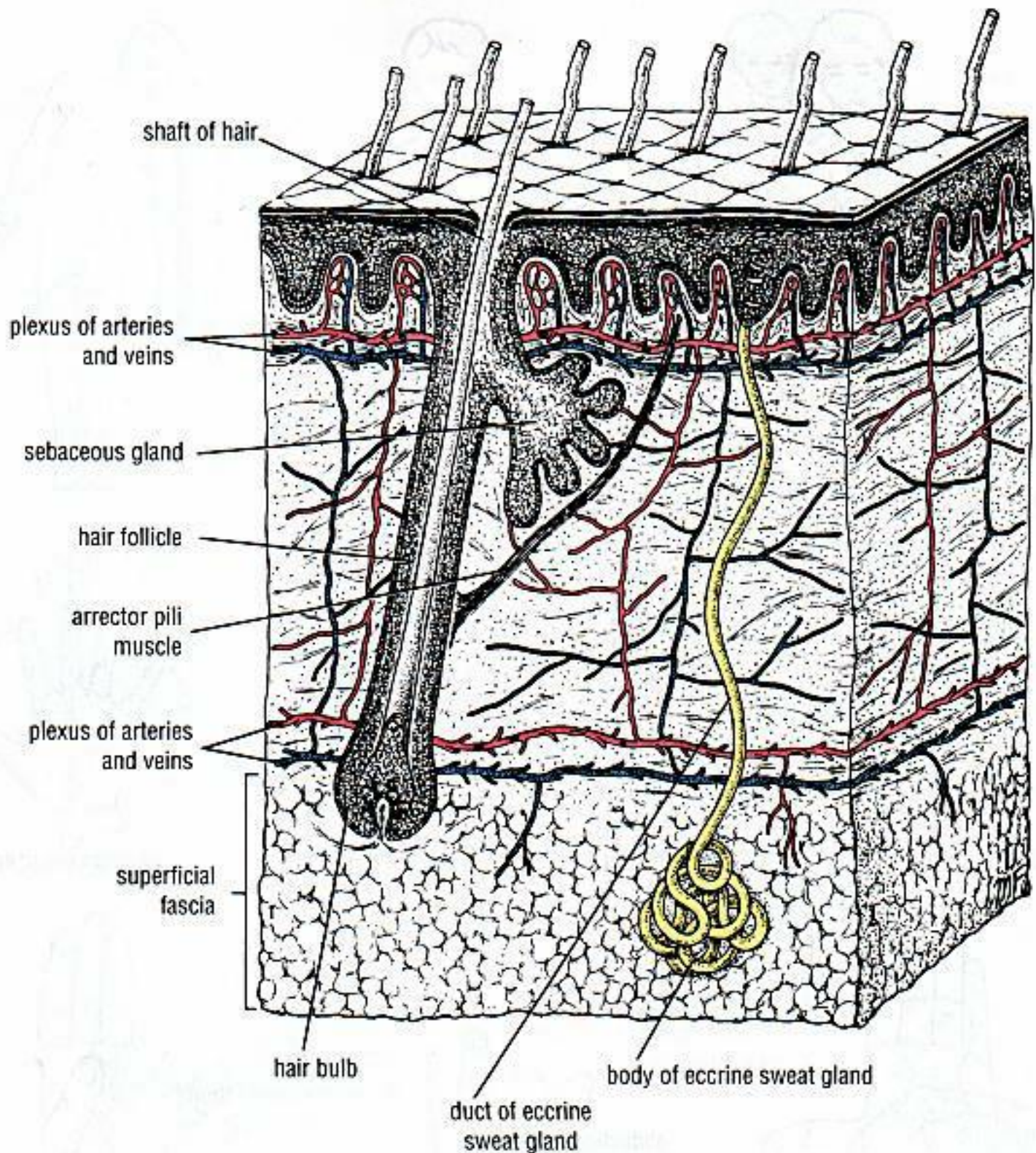


Figure 1-4 General structure of the skin and its relationship to the superficial fascia. Note that hair follicles extend down into the deeper part of the dermis or even into the superficial fascia, whereas sweat glands extend deeply into the superficial fascia.

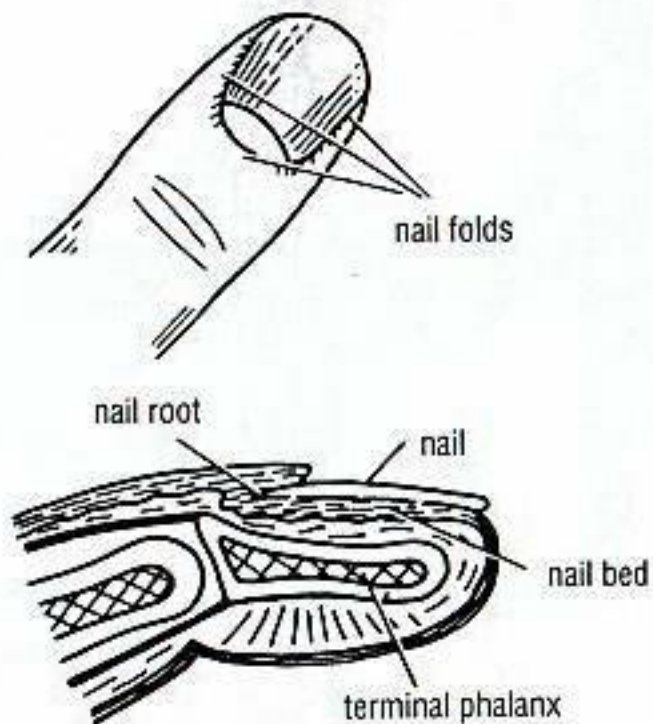
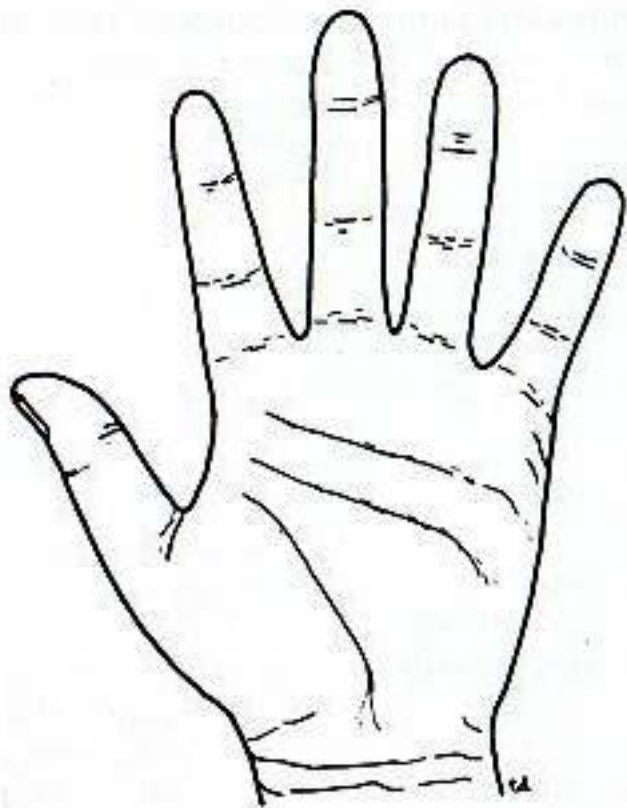


Figure 1-6 The various skin creases on the palmar surface of the hand and the anterior surface of the wrist joint. The relationship of the nail to other structures of the finger is also shown.

SUPERFICIAL FASCIA

(subcutaneous tissue).

* Definition :-

- A mixture of Loose areolar & adipose tissues that connects the skin to deep fascia.
- Consists of adipose tissue & collagen in loose c.T.

((Platysma is a flat ms present in superficial fascia of neck))

* Sites of sup. fascia with NO adipose tissue :-

- 1- Eyelids.
- 2- Auricle of the ear.
- 3- Penis & scrotum.
- 4- clitoris.
- 5- nipple & areola of the breast

* Sites of sup. fascia with Thick collagen :-

- 1- Palm of hand & sole of foot.
- 2- Scalp of head.
- 3- Back of neck.

* Function of Superf. fascia :-

- 1- Allows mobility of skin on deep structures.
- 2- passage for blood vessels & nerves to dermis of skin.
- 3- Insulator layer over body. (fat)
- 4- depot for food storage (fat) & gives body contours.

NB :- In abdomen the superficial fascia is differentiated into

- 1- outer fatty layer.
- 2- deep membranous layer.

NB : Breast is a modified sweat or sudoriferous gland present in superficial fascia

DEEP FASCIA

*Definition:-

- A membranous layer of connective tissue investing the muscles & other deep structures.

*Different names & forms of deep fascia :-

- In the face :- It is absent (except in some places) for facial expression.
- In the neck :- It is formed of 4 layers, and it affects the way of spread of infection.
- In the trunk :- It is thin film of areolar tissue that covers the muscles.
- In the limbs :- It sends a septa to the bones and divides the limb into compartments
- In the joints :- e.g wrist & ankle, forms retinacula which holds long tendons in position.

* Function of deep fascia :-

- 1- Invest the deep structures to bone.
- 2- Gives origin & insertion of some muscles.
- 3- Send **Septa** to bone forming compartments.
- 4- forms retinacula to held long tendons.
- 5- Protect palm & sole by forming palmar & plantar aponeurosis respectively (aponeurosis is thickened deep fascia).

NB :- Subserous fascia :

A type of fascia between muscles & serous membranes lining body cavities ; ① endothoracic ② endoabdominal & ③ endopelvic fascia (the last 2 called extraperitoneal fascia).

Fascia: ① superficial ② deep ③ subserous.

THE MUSCLE

* Types of muscles :-

- ① skeletal (striated) (voluntary) muscles.
- ② Smooth (unstriated) (unvoluntary) muscles. (Plain) (visceral).
- ③ Cardiac (striated) (unvoluntary) muscles

* SKELETAL MUSCLE :-

- The skeletal muscles forms the main bulk of the body (about 40% of body weight).
- The total Number is 620 muscles.

* Structure of skeletal ms. :-

- ① Origin: usually it is the proximal, fixed attachment.
- ② Insertion: usually the distal, mobile attachment.
- ③ Belly:- the fleshy part of the muscle.
- ④ Tendon:- Non fleshy part, it is a cord of fibrous tissue.
 ((Aponeurosis :- flat tendon, (not always present)).
 ((Raphe :- tendon in a form of interdigitate fibers.)).

* Types of skeletal ms. :-

[A]. According to function :-

- ① Prime mover:- The chief muscle responsible for an action.
 - e.g biceps brachii is a prime mover in flexion^{of} elbow
- ② Antagonist:- The muscle opposing action of prime mover.
 - e.g triceps is antagonist to biceps
- ③ Fixator:- a muscle contracts isometrically to stabilize prime mover
 - e.g rotator cuff muscles fixator for deltoid (prime mover)
- ④ Synergist:- To prevent unwanted movement in intermediate joint.
 - e.g Carpi muscles (flexor & extensor) synergist for action of long flexors of fingers (prime mover)

B) According to shape :-

- ① Strap (parallel) :- e.g. sartorius muscle.
- ② Strap with tendinous intersection :- e.g. rectus abdominis.
- ③ Rhomboid :- e.g. rhomboid minor & major.
- ④ Quadrilateral :- e.g. pronator quadratus & thyrohyoid.
- ⑤ Triangular :- e.g. deltoid & temporalis.
- ⑥ Fusiform (spindle) :- e.g. biceps, lumbricals.
- ⑦ Two, three & Four headed :- e.g. biceps, triceps & quadriceps ^{بعض} respectively
- ⑧ Pennate (feather like) :- it may be :-
 - a) Unipennate :- e.g. flexor pollicis longus.
 - b) Bipennate :- e.g. rectus femoris.
 - c) Multipennate :- e.g. deltoid (middle fibers) and subscapularis ms
 - d) Circumpennate :- e.g. tibialis anterior.

Pennate ms is a type of ms according to direction of fibers (oblique)

NB : Multipennate ms has the greatest power than other types but less range of movement

C) According to colour :-

- ① Red ms. :- e.g. soleus (they contract slowly & sustain long time).
- ② White (pale) ms. :- e.g. gastrocnemius. (contract strongly & fatigued quickly).
- ③ Mixed ms. :- most muscles of body are mixed.

*** Muscle tone** :- It is a partial state of contraction at rest.

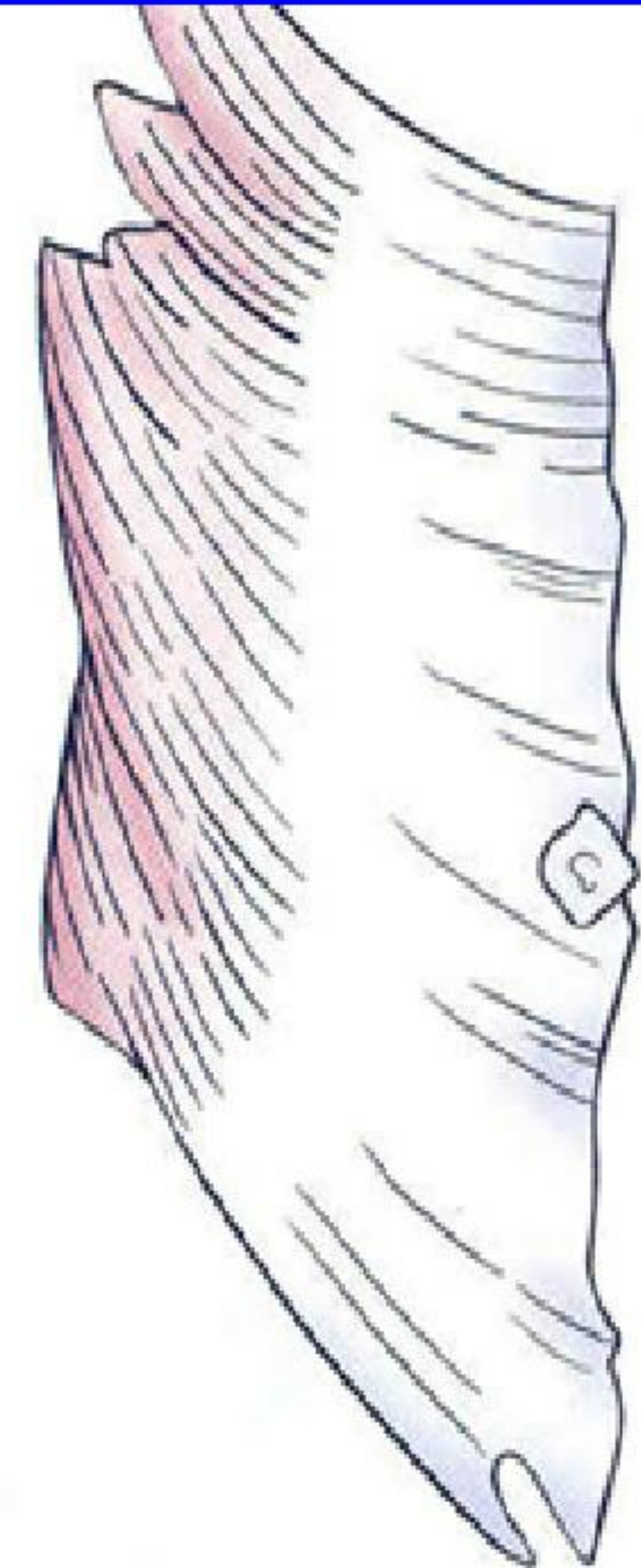
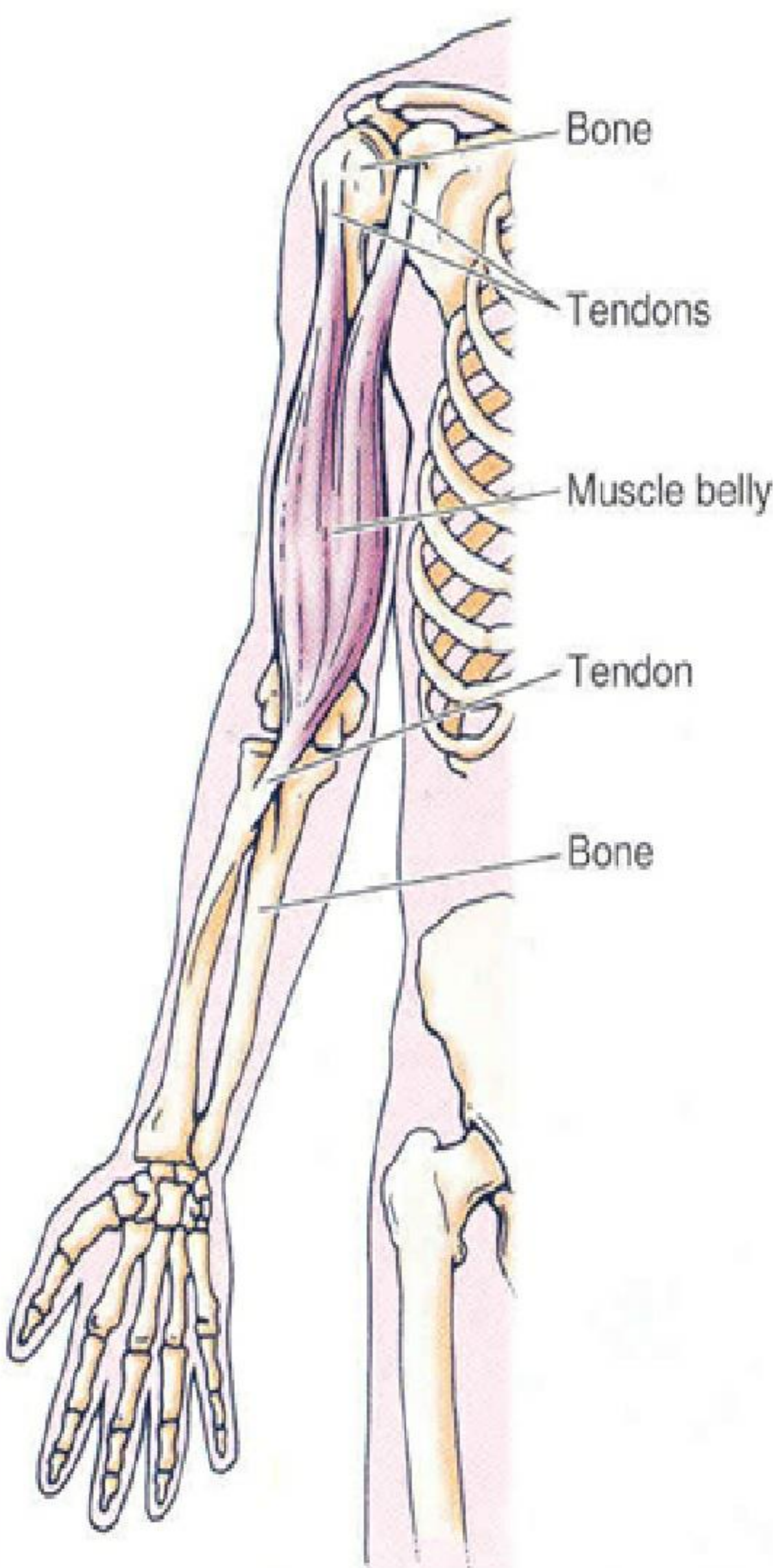
*** Motor unit** :- Motor neuron & all the muscle fibers that supplied by it.

(One motor neuron in Gluteus maximus supply 200 fibers)

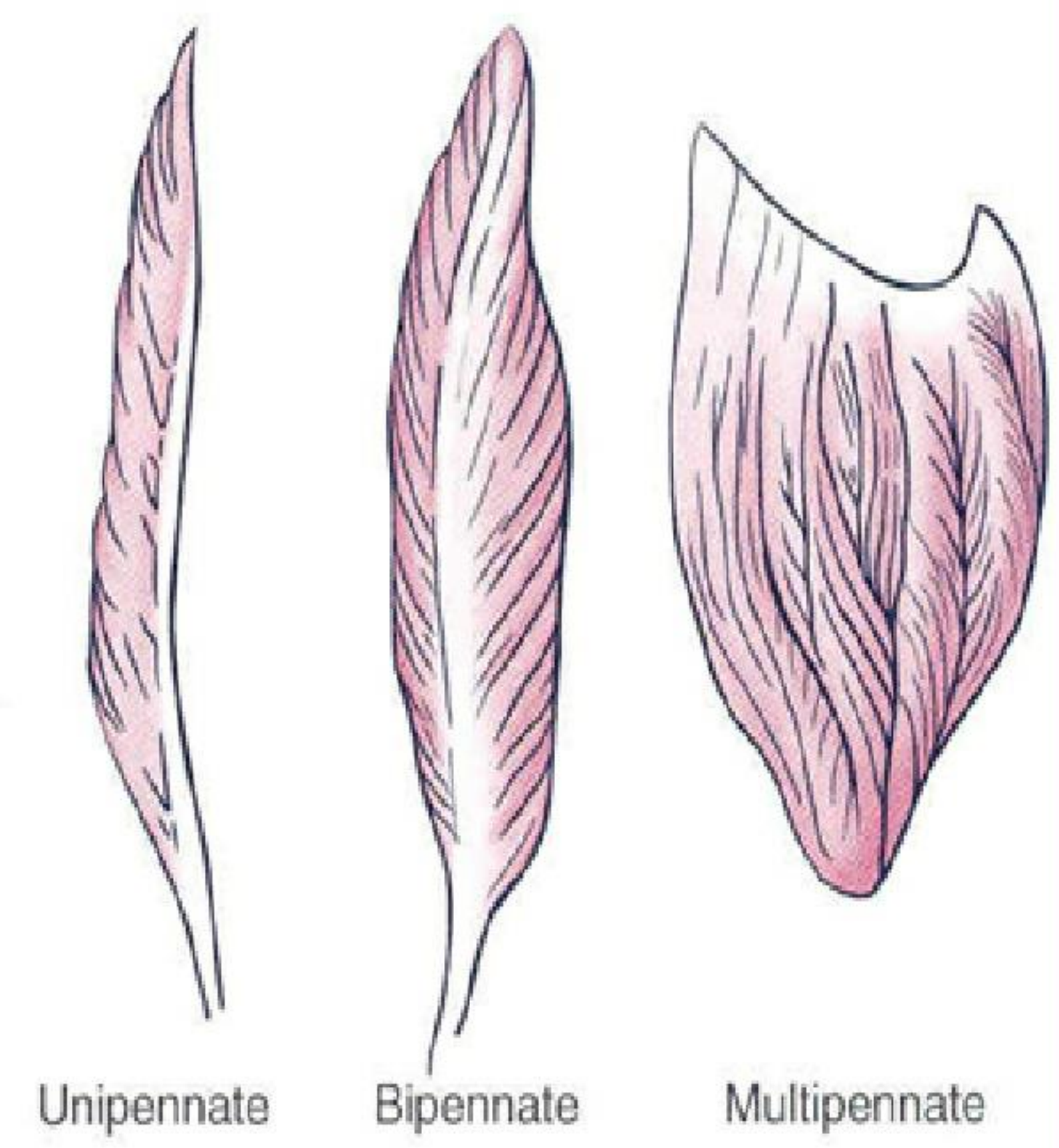
*** Motor Point** :- The place of entrance of nerve to the muscle.
- It is about the mid-point of its deep surface.

*** Motor end plate** :- Each motor neuron ends by dividing into branches, each branch & ms fibers supplied by it are called motor end plate.

*** Motor fibers** :- ① Alpha (larger) fibers → from anterior horn cells
- ② Gamma (smaller) fibers → from spinal cord.



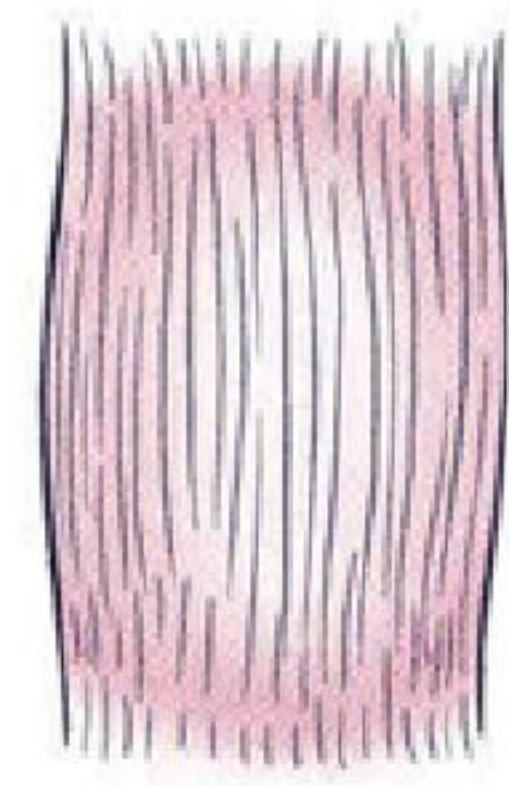
Flat muscle with aponeurosis



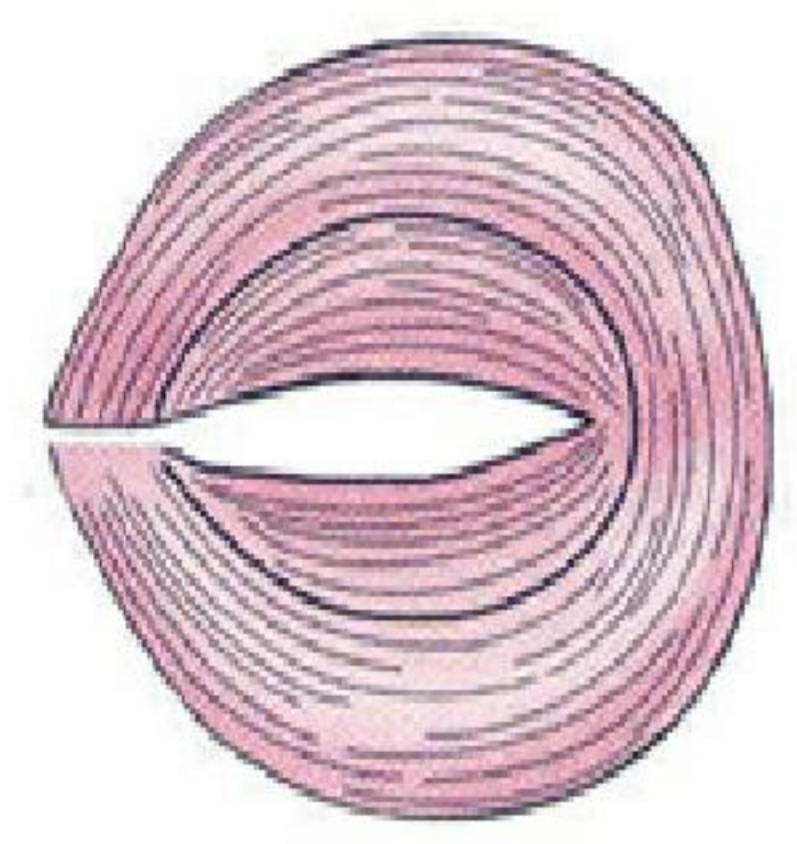
Pennate muscles



Fusiform muscle



Quadrilateral muscle



Circular or sphincter muscle

THE BONES

* Definition :-

- It is a dense C.T. (vascularized & full of minerals).
- About 206 bones.

* Types of bones :-

- [A] - According to ossification (development) :-

- ① Cartilagenous :- e.g long bones (humerus, femur,etc)
- ② Intra-membranous :- e.g flat bones (scapula, clavicle, skull...etc)

they are membranocartilagenous ((but parietal bone of skull is only membranous))

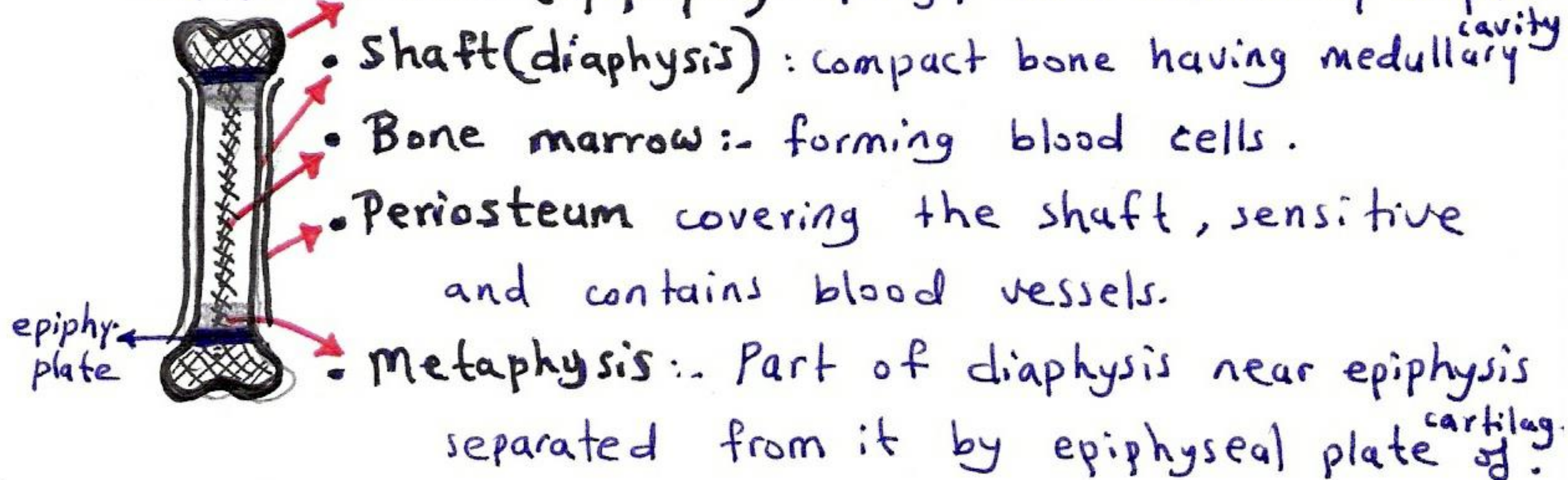
- [B] - According to structure :-

- ① Compact bones :- e.g humerus, femur,etc.
- ② Cancellous (spongy) :- e.g scapula, skull, ... etc.

- [C] - According to shape :-

- ① Long bones :- e.g humerus, femur, radius, ulna, tibia, fibula, ...etc

- have 2 ends (epiphysis) : spongy bone covered by compact bone



- ② Short bones :- e.g carpal & tarsal bones. 
- have no bone marrow (may contain red marrow).

- ③ flat bones :- e.g scapula, skull vault, ribs. 
- have outer & inner plates of compact bones with cancellous bone in between.

- ④ Irregular bones :- e.g vertebrae, skull base, hip bones.
- shape is ill-defined due to bony processes.

- ⑤ Pneumatic bones :- e.g. paranasal sinuses (air cavity inside the bones) which are :-
- 1- maxillary air sinus.
 - 2- Frontal air sinus.
 - 3- Sphenoidal air sinus.
 - 4- Ethmoidal air sinus.

⑥ Cessamoid bones :- e.g. Patella (largest cessamoid bone).

- It is bone inside tendon, it is special type of short bones, to modify pressure & friction. (does not stabilise joint)

NB :- Metacarpal & metatarsal ^{phalanges} bones are long bones but some consider them as short-long bones.
Or miniature long bone

D According to position

*** Functions of bones :-**

- 1- Levers of body & gives body its contour.
- 2- Protection of organs (as brain, heart, ...etc) & support muscle.
- 3- Production of blood cells (RBC) by bone marrow.
- 4- Storage for calcium salts.
- 5- Essential in movements, standing, sitting, ...etc.
- 6- Gives muscle attachments (origin & insertion).

axial → skull, vertebra, ribs, hips
appendicular → Bones of upper & lower limb

Notes :- - Bone & periosteum have sensory nerve supply.

*** Blood supply of bones :-** ① nutrient artery for bone marrow
② epiphyseal, metaphyseal & periosteal arteries.

*** Bone marrow types are:** ① Red bone marrow :- forms RBC.
- found in skull, vertebrae, ribs, sternum, hips, upper ends of humerus & femur
② Yellow (inert) B.M. :-
- composed of fatty tissue.

*** cartilagenous ossification**:- cartilage replaced by bone :-

- 1- Primary centers of ossification in shaft in intrauterine life
- 2- Secondary centers in ends of long bones around birth
- 3- bone formed in all cartilage except epiphyseal plate.
- 4- one plate ossified at 14-16 years (puberty)
- 5- other plate ossified at 18-21 years (adult) no more length.

* Certain features of bones :-

- [A] Elevations :-
- Tuberosity (حديبة)
 - Trochanter (مدور)
 - Tubercle (درنة)
 - Spine (شوكة)
 - Ridge (حافة)
 - Process (زائفة)
 - Epicondyle (زائفة على القبة)
 - Crest (عرف) (linear elevation)
 - Line (خط)

- [B] Depressions :-
- Fossa (حفرة)
 - Notch (جزء مفقود من العظمة)
 - Groove or sulcus (أخود)

- [C] openings :-
- Foramen (ثقب)
 - canal (قناة)
 - Hiatus (ممر ضيق ينتهي بفتحة)

- [D] Articular surface :-
- Head (رأس)
 - Condyle (لقمة)
 - Trochlea (آلة)
 - Facet (سطح متعقيد صغير)



CARTILAGE

* Definition ::

- It is a dense irregular C.T. (with cells & fibers in a gel-like matrix), No blood vessels or lymph or nerve (insensitive).

* Types of cartilage :: (according to matrix)

1. Hyaline cartilage:- e.g. epiphyseal plate & ends of the long bones (articular cartilage) & costal cartilage.
2. Fibrocartilage :: (white cartilage): e.g. intervertebral discs, and symphysis pubis.
3. Elastic cartilage :: (yellow cartilage): e.g. tip of nose, external ear (auricle) & auditory tube, epiglottis.

LIGAMENTS

* Definition :

- It is a cords of C.T. uniting 2 or more structures.

* Types of ligaments ::

1. Fibrous (white) ligaments :: e.g. iliofemoral lig. of hip & collateral lig. of elbow
 - It is unstretchable, formed of dense collagen fibers.
2. Elastic (yellow) ligaments :: e.g. ligamentum flavum of vertebra and calcaneonavicular ligament of foot.
 - It is stretchable & formed of elastic tissue.

THE JOINTS

* Definition :-

- Meeting (Joining) (union) or (connection) of two or more bones.

* Classification of Joints (types) :-

(I) According to tissue between bones :-

- ① Fibrous.
- ② Cartilagenous $\left\{ \begin{array}{l} \text{Primary (hyaline cartilage)} \\ \text{secondary (using fibrocartilage).} \end{array} \right.$
- ③ Synovial.

(II) According to Presence or absence of a cavity :-

- ① Joints with cavity $\rightarrow$ e.g. fibrous joints.
- ② Joints without cavity (solid) $\rightarrow$ e.g. ① cartilagenous (1st & 2nd)
② Synovial joints

(III) According to range of movement :-

- ① No movement $\rightarrow$ e.g. Fibrous & Primary Cartilagenous.
- ② Little movement $\rightarrow$ e.g. secondary Cartilagenous joints.
- ③ freely moving $\rightarrow$ e.g. synovial joints

NB: Factors affecting stability of the joints are :-

- ① Shape of the bone :- e.g. ball & socket joints.
- ② Ligaments :- e.g. fibrous ligaments.
- ③ Muscle tendon around the joint :- e.g. rotator cuff.
- ④ Muscle tone. (main factor in stability)

Fibrous Joints :- (least common).

- The two bones are connected together by fibrous tissue.

① Sutures of skull :- (connected by thin fibrous tissue)

- (ossifies with age).

② Syndesmosis :- (connected by very strong fibrous tissue)

- (does not ossify)

- e.g. inferior tibiofibular joint & interosseous membrane between ulna & radius.

③ Gomphosis :- (connected by collagen fibrous tissue)

- (does not ossify).

- e.g. joint between teeth & jaws.

Cartilagenous Joints :-

① Primary cart. Joint (synchondrosis) :-

- Bones are connected by hyaline cartilage.

- (e.g.) • Junction between epiphysis & diaphysis (in growing bone),
• between 1st rib & manubrium sterni.

② Secondary cart. Joint (symphyses) :-

- Bones are connected by fibro cartilage.

- (e.g.) • intervertebral joints, symphysis pubis & manubriosternal ^{joint} ↑

Synovial Joints :-

* The synovial joints have the following character :-

① There is a cavity between the bones.

② The cavity is filled by synovial fluid that is secreted from synovial membrane

③ synovial membrane is covered by fibrous capsule.

④ articular surfaces (ends of long bones) are covered by hyaline cartilage and connected by ligaments

Types of synovial Joints :-

(I) According to shape of articular surfaces :-

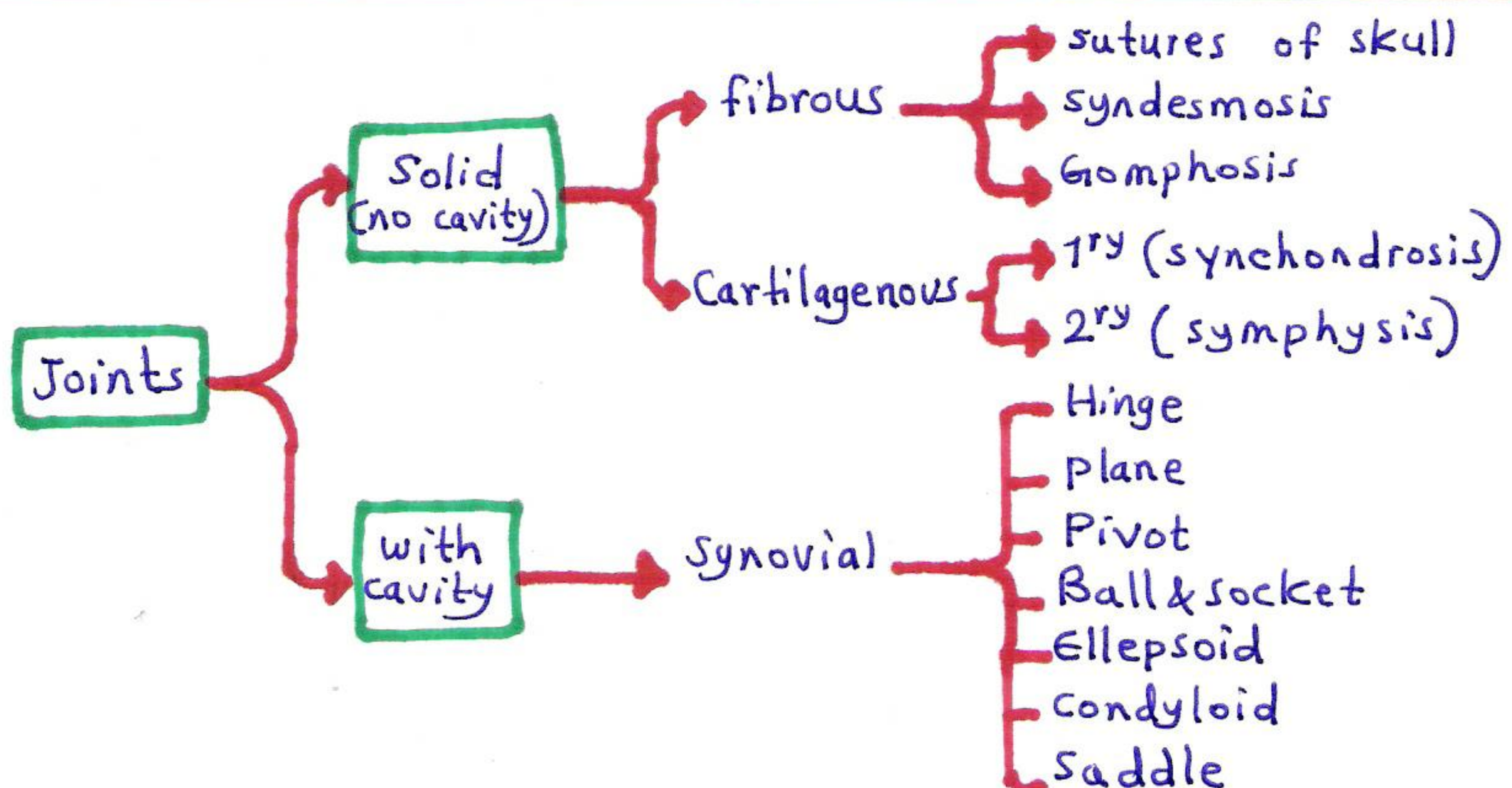
- 1- Hinge joint :- e.g. elbow & ankle [knee is modified hinge].
- 2- Plane joint :- e.g. sternoclavicular & acromioclavicular joints
(gliding) - intertarsal & intercarpal joint.
- 3- Pivot joint :- e.g. - atlantoaxial & radio-ulnar joints.
- 4- Ball & socket :- e.g. - Shoulder & hip joints.
- 5- Ellipsoid joint :- e.g. - Wrist joint
- 6- Saddle joint :- e.g. carpo-metacarpal joint of the thumb.
- 7- Condyloid joint :- e.g. metacarpo-phalangeal joints of all fingers (knee may be considered condyloid).

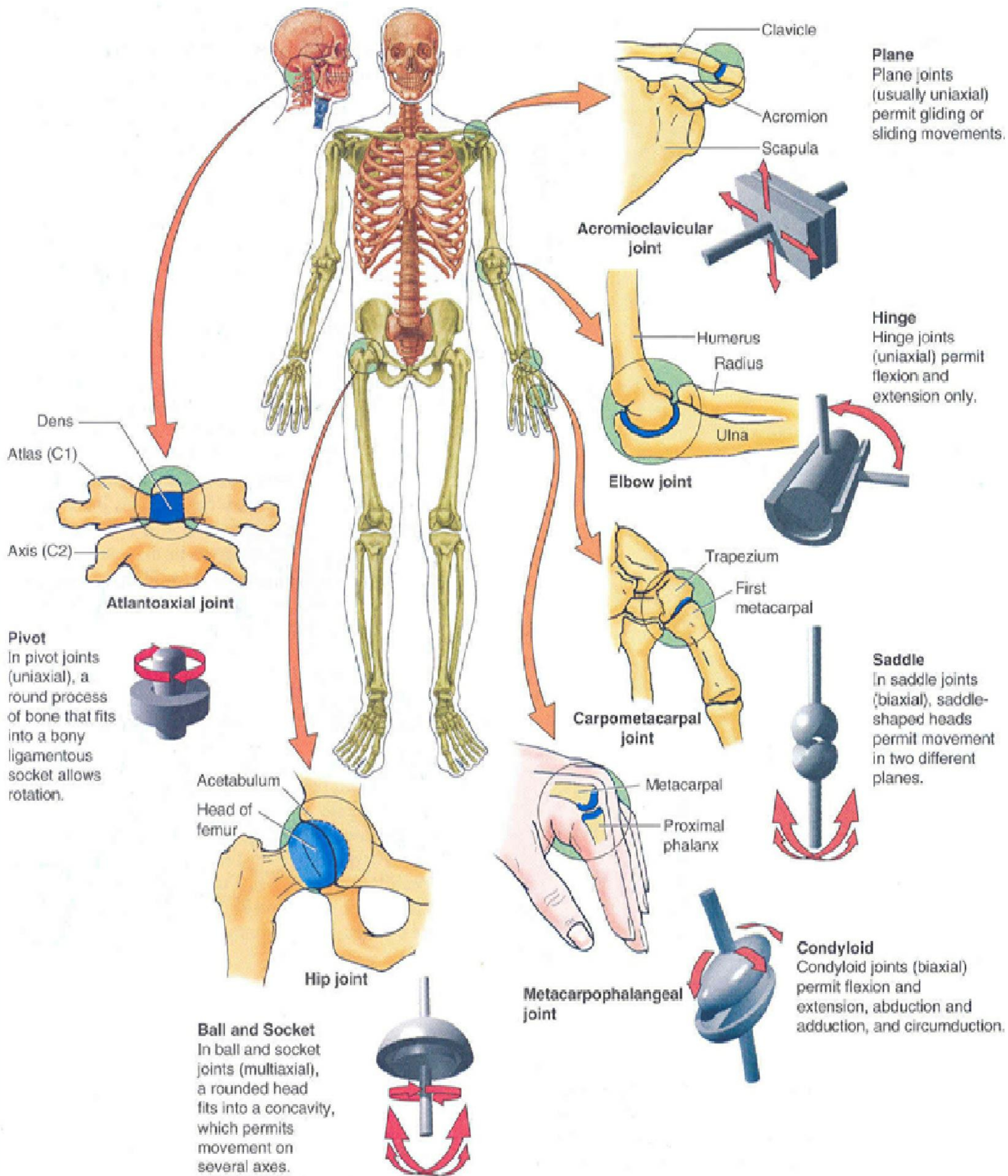
(II) According to axis of movements :-

- 1- Uni-axial joints :- e.g. hinge & pivot joints.
- 2- Bi-axial joints :- e.g. Ellipsoid, saddle & condyloid joints.
- 3- Multi-axial joints :- e.g. ball & socket joints.

* Nerve supply of the joint :-

- The capsule & ligaments of joints are supplied by sensory nerves
- Hilton's law :- the sensory nerve supplying the joint also supplies the muscle moving the joint & the skin over the insertion of these muscles.





SEROUS MEMBRANES

* Definition :-

- Serous membranes; are closed spaces lined by a thin membrane and contain a little film of serous fluid.
- They are invaginated by organs & tendons :, e.g.
 - Pleura : around lung , Pericardium : around heart
 - Peritoneum : around viscera in abdomen.
 - Bursa & synovial sheaths.

* **Bursa :-** works as a lubricant & prevent friction of tendons with bones or other structures.

- Present commonly close to joints & may communicate with joint cavity e.g.
 - Subscapularis bursa (shoulder).
 - Suprapatellar bursa (knee).

* **Synovial sheaths :-** covers tendons to reduce friction between tendons & surrounding structures.

- It is a tubular bursa around tendons.

CARDIO-VASCULAR SYSTEM

- It consists of : ① Heart & ② Blood vessels.

(I)-THE HEART:

- The heart pumps the blood to body.
- It is supplied by coronary arteries and venous drainage is by coronary sinus.
- It consists of two atria (Rt & Lt atrium) and two ventricles (Rt & Lt ventricle).
- From ventricles arise the arteries & into the atrium drain the veins.

(II)-BLOOD VESSELS:

- Blood vessels are of three types; arteries, veins & capillaries
- The artery arises from ventricle of heart as large artery (aorta & pulmonary artery) and divides to give branches → gives medium & small arteries → the smallest branches are called arteriole (diameter < 0.1 mm)
- The arterioles open into capillaries (very small network) → which forms capillary bed (in which occurs interchange of oxygen, nutrient & fluids) → then capillary beds give thin walled venule → which joined to form veins that enlarges from small, medium to large veins to end into superior & inferior vena cava that opens into right atrium of heart
- The arteries carrying oxygenated blood to body Except Pulmonary artery (carry non oxygenated blood to lungs)
- The veins carry ^{non}oxygenated blood to heart except Pulmonary veins (carry oxygenated blood to heart).

① THE ARTERIES :

■ The arteries are of 3 types :-

(1) Large, elastic (conducting) arteries:-

- e.g aorta, pulmonary arteries.

(2) Medium, muscular (distributing) arteries:-

- e.g brachial & femoral arteries.

(arterioles are a resistant vessel)

(3) Small arteries & arterioles:-

- e.g digital arteries (small), arterioles are < 0.1 mm.

■ Examples of tortuous arteries:-

① Superficial temporal artery.

② Facial artery.

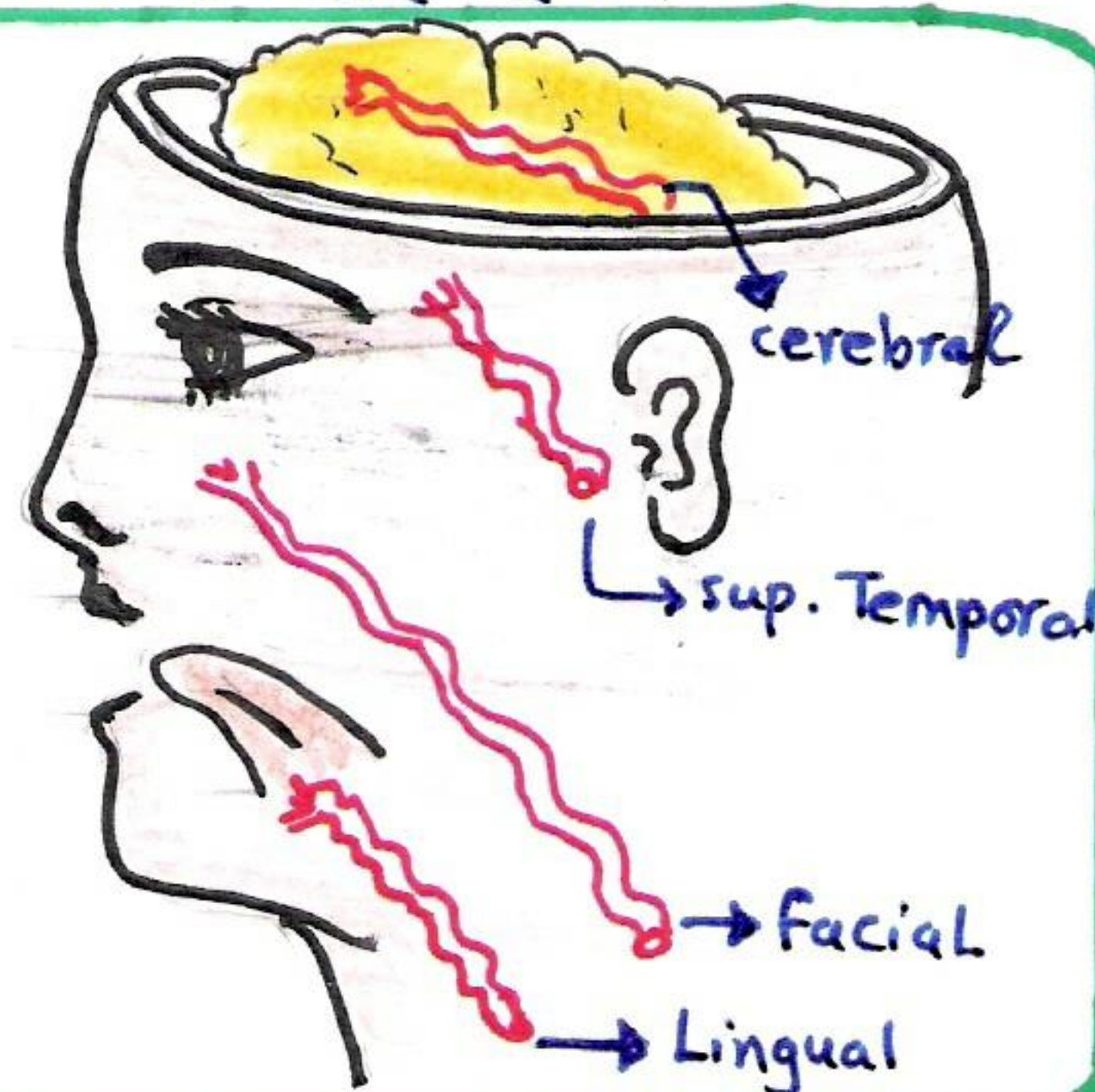
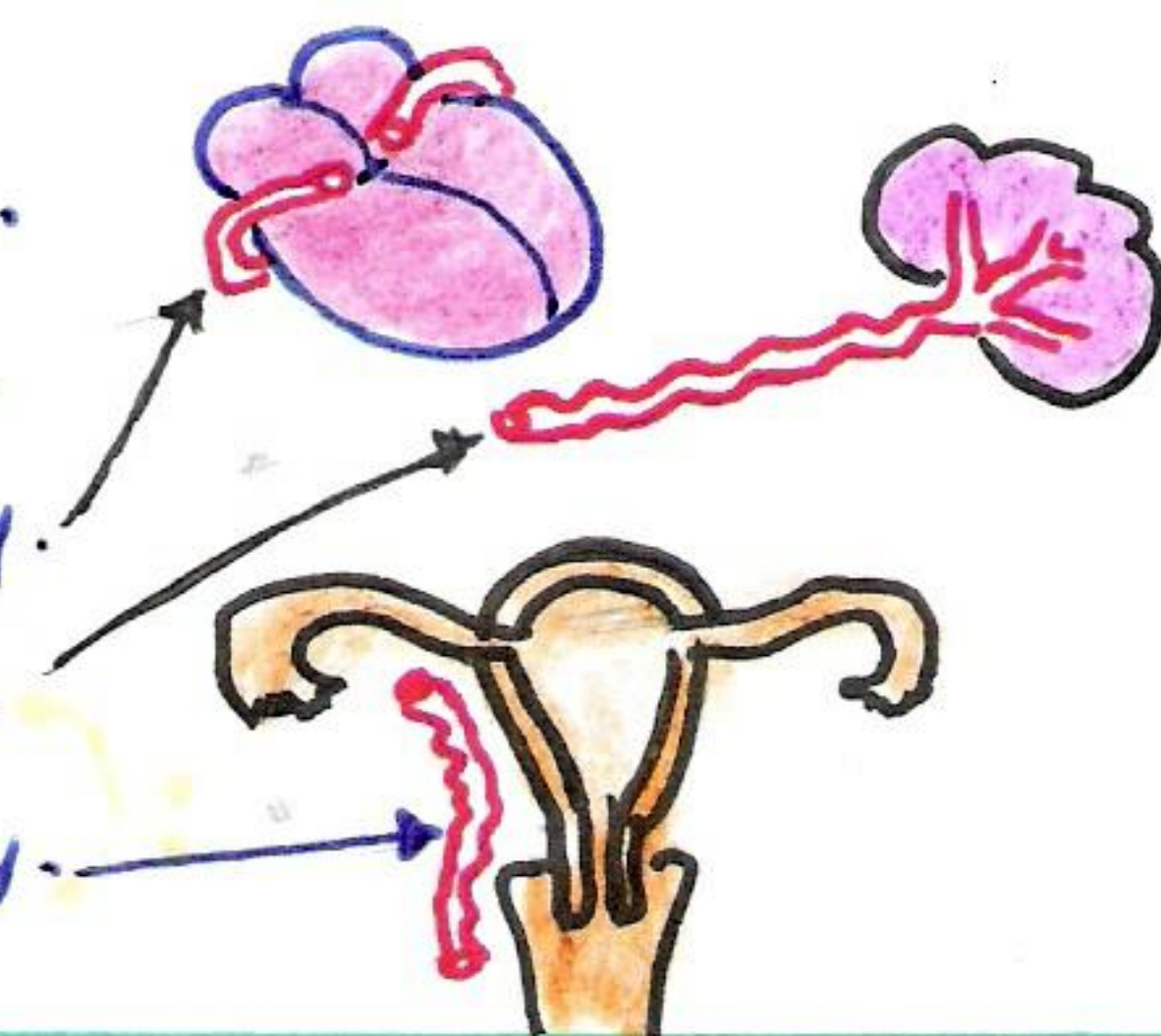
③ Lingual artery.

④ Cerebral artery.

⑤ Coronary artery.

⑥ Splenic artery.

⑦ Uterine artery.



* Arterial anastomosis:-

■ They are communications between branches of two or more neighboring arteries (more around joints).

■ Function :- 1- equalize pressure between branches.

2- alternative channels of blood supply.

3- Preserve distal flow when joint flexed.

■ Examples of arterial anastomosis:-

① circulus arteriosus (circle of Wills in brain).

② Around wrist & ankle.

③ Around elbow & knee.

④ Cruciate anastomosis around neck of humerus

⑤ Cruciate " " " " femur

* End arteries :-

They are more frequently found in the vital organs

① Anatomical end arteries :-

- No anastomosis (arterial) so cut of blood supply → damage or death of area supplied by that branch. e.g. retinal artery if blocked → blindness

• Examples of anatomic end arteries :-

- ① Central retinal artery. → 
- ② Pulmonary artery. → 
- ③ Splenic artery. → 
- ④ Renal artery. → 
- ⑤ Nutrient a of bone. → 

② Functional end arteries :-

- There is arterial anastomosis but insufficient e.g. coronary arteries of heart if blocked → infarction.

• Examples of functional end a :-

- ① Coronary artery. → 
- ② cerebral artery. → 
- ③ Mesentric artery (intestine). → 

* Arterial pulsation :-

- Some arteries can be palpable e.g.
 - Axillary, brachial & radial (most commonly used.)
 - Femoral, Popliteal & dorsalis pedis a.
 - Common carotid, facial & superficial temporal a.

N.B.: Blood circulate inside three systems of vessels

- ① Pulmonary circulation :- Provide oxygenated blood from lung to heart & give nonoxy. bd to lung.
- ② Portal circulation :- Provides nutrients from intestine to the liver (then by hepatic veins into I.V.C).
- ③ Systemic circulation :- Provides oxygen & nutrients from heart to body & give nonoxy. bd to heart by SVC and IVC.

NB:- Some veins have no valves

- veins are organised into superficial & deep veins

② THE VEINS :

- The veins have lower pressure than arteries and their walls are thinner & have capacity to expand more than arteries. (**capacitance vessel**)
- Venules Arises from capillaries & unite to form small veins, the small veins are tributaries of medium then large veins.
- Veins usually have valves so blood goes in one direction (toward heart).
- Large veins (e.g. superior & inferior vena cava) have a well-developed tunica adventitia.
- Medium veins (e.g. cephalic, basilic, small & great saphenous V) have a valves,
- N.B:- Medium sized arteries (e.g. brachial & tibial arteries) usually accompanied by two or more veins which are called VENAE COMITANTES "accompanying veins" e.g. venae comitantes of brachial artery.
- N.B:- Veins usually comes out from organs (drainage) Except portal vein which enters the liver (supply) but drains gastro-intestinal tract so that the portal vein connects two capillary beds (liver & intestine).

③ CAPILLARIES

NB: Superficial veins are usually used for vein puncture.

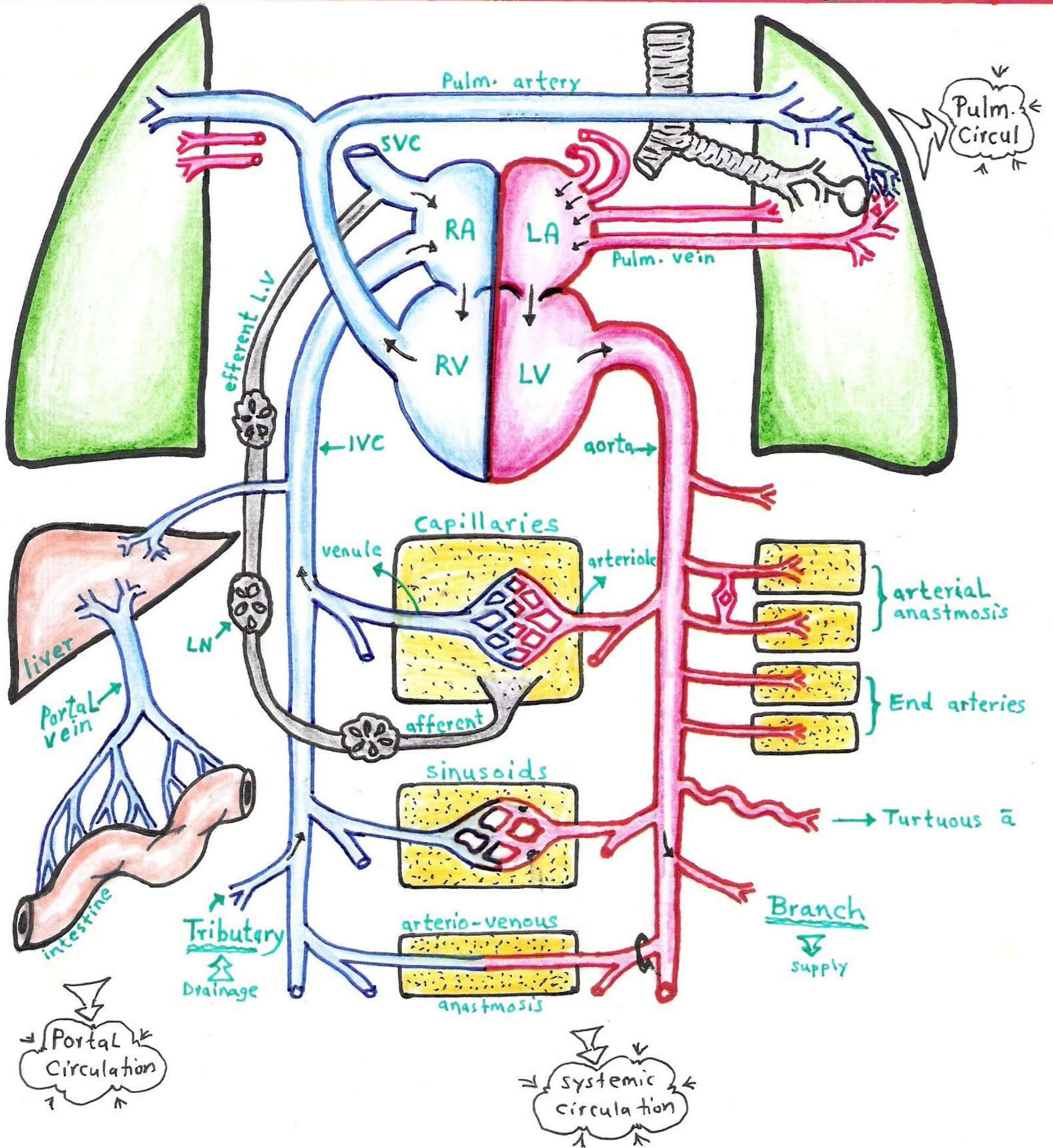
- Capillaries connects artery to veins in most of body but in some places they connected directly (arterio-venous anastmosis) or by large capillaries (sinusoids) sinusoids are:- thin walled blood vessels with irregular cross diameter & are wider than capillaries.

* Ex. of arterio-venous anastmosis:-

- ① Tip of fingers & toes. ② tip of nose. ③ ear lobule.

* Ex. of sinusoids:-

- ① Liver ② spleen ③ bone marrow. ④ some endocrine glands.



Cardio-Vascular & Lymphatic system.

LYMPHATIC SYSTEM

- It is an essential drainage system that return the Lymph to the blood stream.
- Lymph is a clear colourless fluid formed in tissue by blood plasma, proteins, Lymphocytes & waste products. (intestine has a milky white lymph because of its high fat content → and called chyle.)
- It is an important system for ① immunological defence against bacteria & viruses, ② also absorb & transport fat. ③ produce lymphocyte & antibody
- Lymphatic system is composed of ① Lymph vessels. ② Lymph nodes. ③ Lymphatic aggregation.

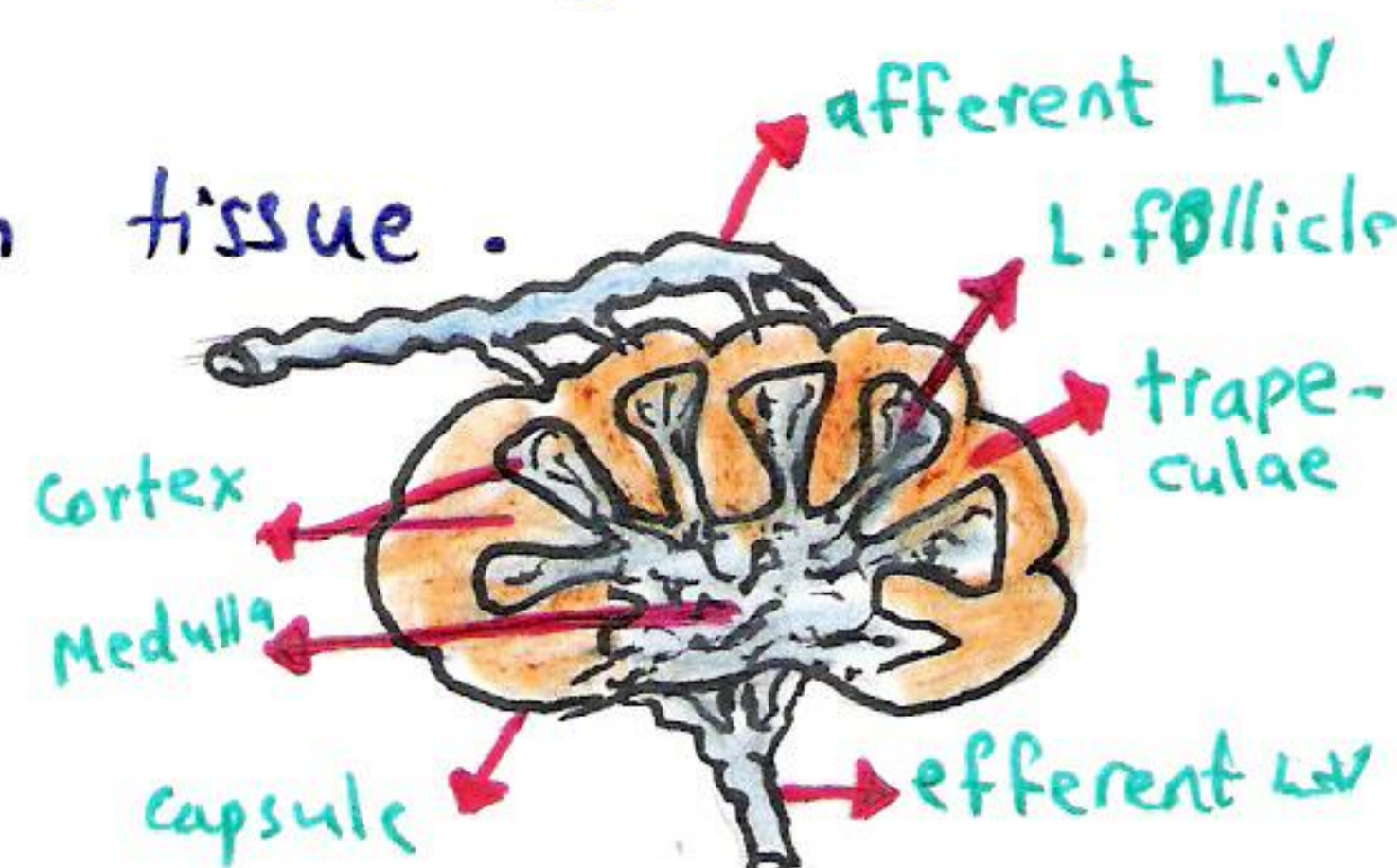
① Lymph vessels :-

- They drain a fluid (lymph) from tissue returning it to blood.
- They have ^{numerous} valves giving it beaded appearance.
- Lymph capillaries are a network of fine vessels that drain lymph from tissue, they are wide with thin endothelium
- Afferent L. vessels: is lymph vessel that carry lymph to L. node
- Efferent L.V. :- is L.V. that transport lymph away from L.N.
- Right lymphatic trunk :- drains lymph from right upper quadrant of body. (Rt half of head, neck & thorax & upper limb)
- Thoracic duct :- drains lymph from remainder (rest) of the body.
- Both Rt L. trunk & thoracic duct end into large vein in thorax.



② Lymph nodes :-

- Small masses of Lymphatic tissue located along the course of lymphatic vessels.
- They filter the lymph drained from tissue.
- each node receives afferent lymphatics & gives larger fewer efferent lymphatics.



- Lymphatic tissue is a type of connective tissue that contains large amounts of lymphocytes.

*** Sites of lymphoid tissue (Lymph. aggregation):**

- 1- Thymus.
- 2- Tonsils.
- 3- Spleen
- 4- Lymphatic nodules & Lymph nodes.
- 5- Lymphatic aggregation in wall of digestive tract → Peyer's patches
- 6- Myeloid tissue in red bone marrow.

*** Sites of NO Lymphatic ::**

- 1- Brain.
- 2- Spinal cord.
- 3- Eyeball (cornea).
- 4- Cartilage
- 5- Bone marrow.
- 6- Alveoli of the lung.
- 7- Inner ear.

*** Groups of Lymph nodes:-**

- 1- axillary nodes (in axilla).
- 2- Cervical nodes (in neck).
- 3- Inguinal nodes (in groin).
- 4- Mediastinal nodes (in chest)
- 5- Abdominal nodes (in abdomen).

NERVOUS SYSTEM

- The nervous system (together with the endocrine system), controls and integrates the activities of the body.

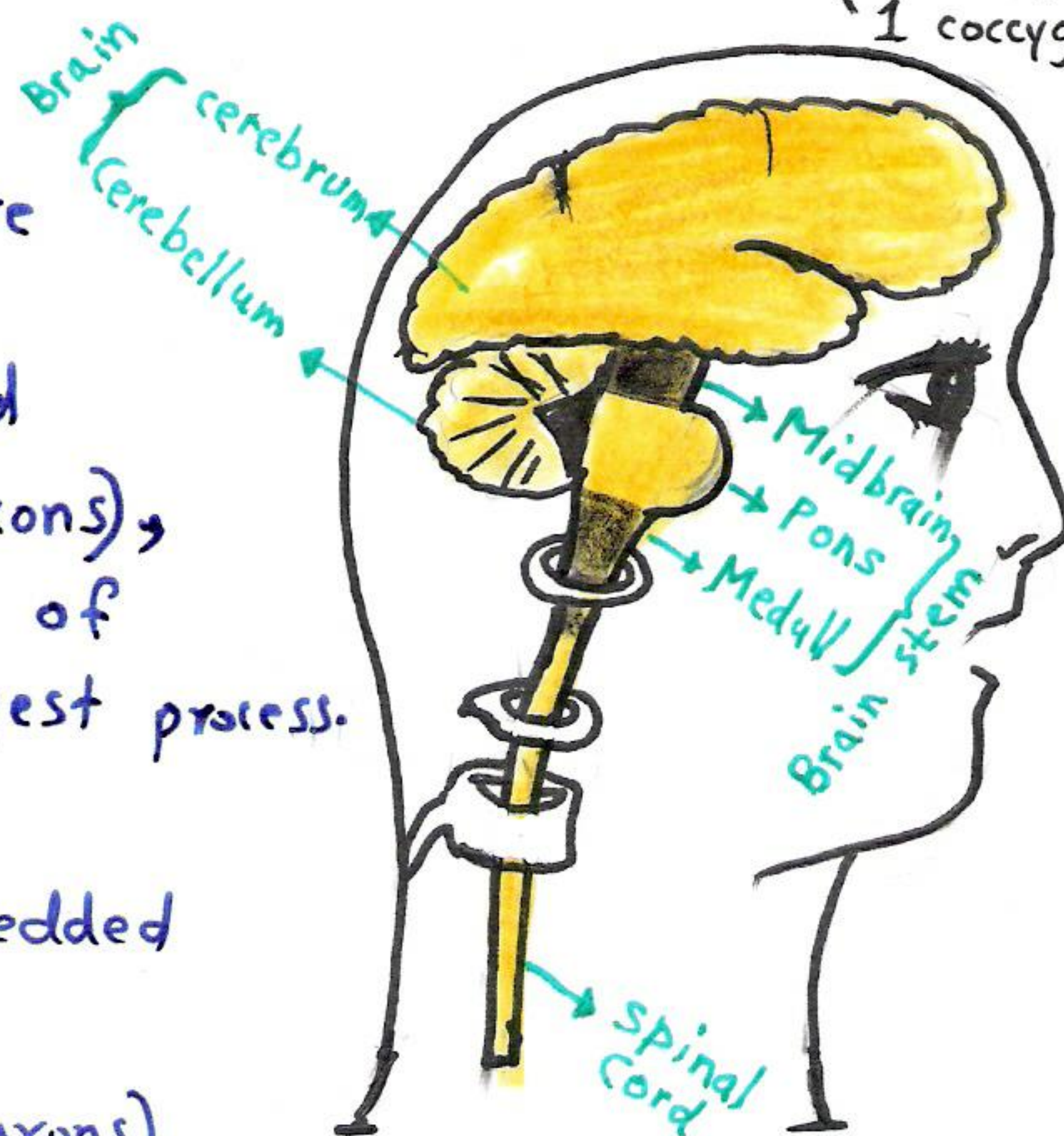
* Divisions of nervous system (NS) :-

- * Functionally $\left\{ \begin{array}{l} \text{Somatic N.S. :- controls voluntary activity.} \\ \text{Autonomic N.S. :- controls involuntary activity.} \\ \quad \text{(sympathetic \& parasymp.)} \end{array} \right.$

- * Anatomically $\left\{ \begin{array}{l} \text{Central N.S.} \left\{ \begin{array}{l} \text{Brain (cerebrum, cerebellum \& brain stem).} \\ \text{Spinal cord.} \end{array} \right. \\ \text{Peripheral N.S.} \left\{ \begin{array}{l} \text{Cranial nerves (12 pairs)} \\ \text{Spinal nerves (31 pairs)} \end{array} \right. \end{array} \right.$
- $\left\{ \begin{array}{l} 8 \text{ cervical} \\ 12 \text{ thoracic} \\ 5 \text{ lumbar} \\ 5 \text{ sacral} \\ 1 \text{ coccygeal} \end{array} \right.$

* Central N.S. :-

- Composed of neurons that are supported by neuroglia.
- Neurons :- are nerve cells and their processes (dendrites & axons), dendrites are short processes of cell body while axons is longest process.
- CNS is organized into
 - Gray matter: nerve cells embedded in neuroglia.
 - White matter: nerve fibers (axons) embedded in neuroglia.



* Peripheral N.S. :-

- ① Cranial nerves: are 12 pairs of nerves arise mostly from brain stem and distributed (through skull foramina) into the head & neck (except vagus "xth" which also supply thorax and abdomen).

② Spinal nerves:- are 31 pairs that leave the spinal cord passing through inter-vertebral foramina in the vertebral column.

- They are named according to region of vertebra:-
(8 cervical, 12 thoracic, 5 lumbar, 5 sacral & 1 coccygeal).

- Each spinal nerve is connected to spinal cord by two roots (anterior & posterior roots), united to form spinal nerve trunk, which divided into two rami (ant. & post. rami) and meningeal branches (also gives the rami communicantes (sympathetic) in thoracic region)

• Anterior root (efferent):-

- Called motor fibers, originate from anterior horn cells of spinal cord (gray horn), carry impulse away from CNS (to skeletal muscle).

• Posterior root (afferent):-

- Called sensory fibers; enters to posterior horn of the spinal cord, carry sensations (touch, pain, temperature, ...etc) into spinal cord (CNS).

• Trunk of spinal nerve:-

- It is the union of anterior & posterior roots (mixed).

• Anterior (ventral) ramus:-

- branch of trunk, pass anteriorly to supply muscles & skin over antero-lateral body wall & limbs.

• Posterior (Dorsal) ramus:-

- branch of trunk, passes posteriorly to supply muscles & skin over the back of body.

• Posterior root ganglion:-

- Swelling on post. roots containing cell bodies of its sensory ^{fibers}

• Meningeal branch:-

- supply vertebrae & meninges that covers spinal cord.

• Rami communicantes:-

- Branches of thoracic spinal nerves those associated with sympathetic Part of ANS

* Plexuses :-

- Joining of anterior (ventral) ^{Primary} rami at root of limbs
- They are (cervical, brachial, lumbar, sacral and coccygeal plexuses).

* Dermatome :-

- Unilateral area of skin innervated by the fibers of a single spinal nerve.

* Myotome :-

- unilateral muscle mass receiving innervation from fibers conveyed by a single spinal nerve.

* Autonomic N.S. :-

- ANS is concerned with innervation of involuntary structures such as heart, smooth muscles and glands in the body.
- It is distributed throughout CNS & PNS.
- ANS is divided into

① Sympathetic :-

- efferent fibers are located in gray matter of the spinal cord from T₁ (1st thoracic) to L₂ (2nd lumbar) segment (Thoraco-Lumbar).

② Parasympathetic :-

- efferent fibers are located in brain (III, VII, IX & X) and sacral segment (S₂, 3, 4) of spinal nerve, so called (Cranio-sacral).

- So lateral horn cells in the thoracic region of the spinal cord are sympathetic cells

Musculature

ANATOMY CHART

